

Quantum

Magnetics®

An InVision Technologies Company



# *Remote Automatic On-line Sensor*

Presentation to  
**DOE/OIT Sensors and Controls '01  
Information Exchange Meeting**

June 7, 2001

Presented by  
Erik E. Magnuson

Q u a n t u m

M a g n e t i c s<sup>®</sup>

*An InVision Technologies Company*



## ***QM Corporate Structure***

- Parent company is InVision Technologies
  - \* Computed Tomography X-ray scanners (CTX series) for airport security
- “Sister” company WoodVision
  - \* Formed to apply CTX technology for optimizing sawmill operation
- “Sister” company Inovec
  - \* Makes laser based sawmill optimization equipment, bought by InVision in 2000

Q u a n t u m

M a g n e t i c s<sup>®</sup>

*An InVision Technologies Company*



## ***Quantum Magnetics Contracts***

- Landmine detection for Army and Marine Corps using Quadrupole Resonance (QR) technology
  - \* Synergy with DOE-OIT work
- QR Strain Gauge for BMDO
- Metal (weapons) detection using passive magnetic sensors (commercial sales)
- Liver scanner using low frequency magnetic sensors – Hemachromatosis screening
- Measurement of Propellant aging using MR

Q u a n t u m

M a g n e t i c s<sup>®</sup>

*An InVision Technologies Company*



## ***Remote Automatic On-line Sensor***

- MR is non-contacting, non-destructive
- MR is amenable to computer control
- MR is useful for measuring material properties, for example
  - \* Moisture content
  - \* Relative viscosity
  - \* Molecular rigidity

Q u a n t u m

M a g n e t i c s<sup>®</sup>

*An InVision Technologies Company*



## ***Program Objectives – year 1***

- Refine specifications in consultation with IOF industries
- Perform a market survey to determine market size
- Perform lab tests to demonstrate feasibility
- Design Magnet and RF system
- Finalize design and obtain Vendor quotes

**Q u a n t u m****M a g n e t i c s®***An InVision Technologies Company*

## ***IOF survey – desired data***

- Forest Products – moisture in wood
  - \* Current technology not sufficiently accurate
- Agriculture – moisture and oil content
- Mining – moisture content in coal
  - \* Ideally total BTU content
- Petroleum – on-line analysis
  - \* Water or metal content measurement
  - \* Reservoir exhaustion (secondary recovery)

**Q u a n t u m****M a g n e t i c s®***An InVision Technologies Company*

## ***Forest Products – wood moisture***

- Post kiln measurements
  - \* Primarily QA, MR usually not sufficiently better than current methods to justify cost
- In-kiln measurements
  - \* Current methods leave much to be desired, however kiln operation imposes strenuous size and environmental problems
- Sorting green lumber before kiln drying
  - \* Appears to be best match for initial MR market introduction

**Q u a n t u m****M a g n e t i c s®***An InVision Technologies Company*

## ***Green-sort by moisture content***

- Problem – moisture content of green lumber varies dramatically
- Current practice is air-drying to bring wood to equilibrium, however 5-8% of wood is damaged during air-drying, also increases costs
- Sorting by moisture content would allow for more uniform drying of lumber
  - \* Accuracy of current methods completely insufficient at high moisture content



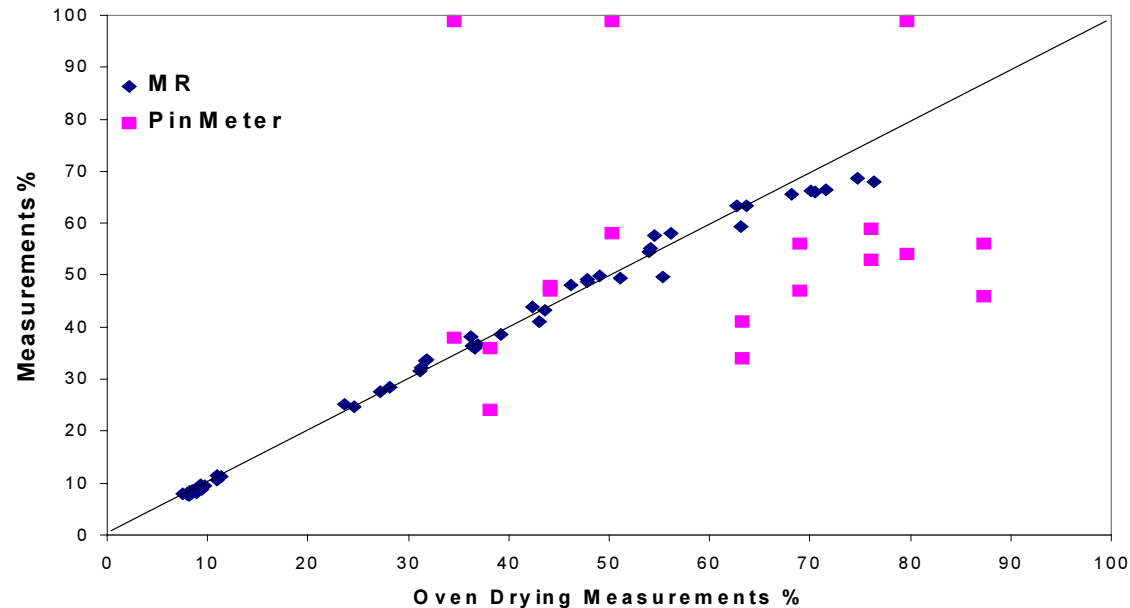
Quantum

Magnetics®

An InVision Technologies Company



# MR versus Pin meter accuracy

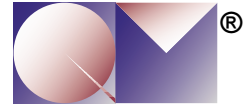


Comparison of measurement accuracy between pin type meters and MR, straight line is ideal. Note that MR is significantly more accurate at typical green wood moisture content (>40%)

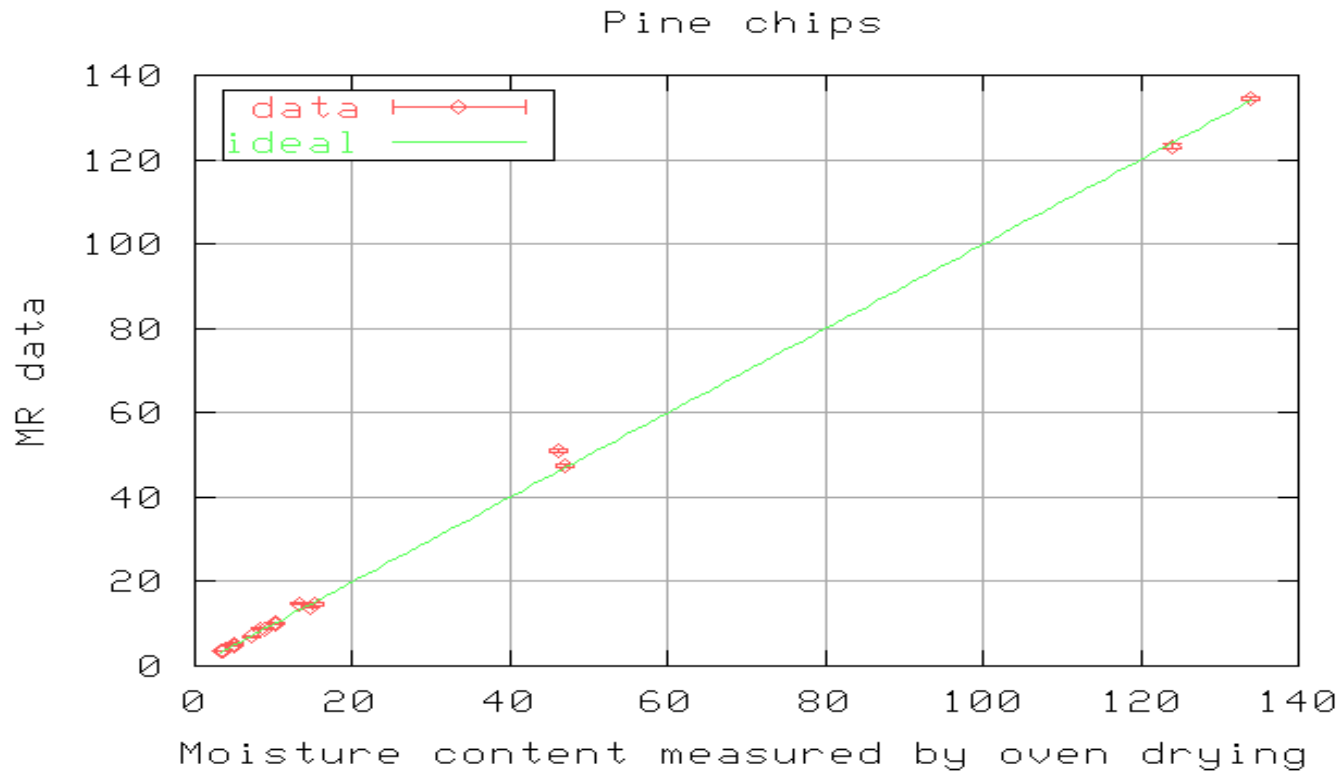
Quantum

Magnetics®

An InVision Technologies Company



# MR measurement of pine



Note outstanding accuracy at M.C. > 100%  
where M.C. = (moisture weight)/(dry weight)

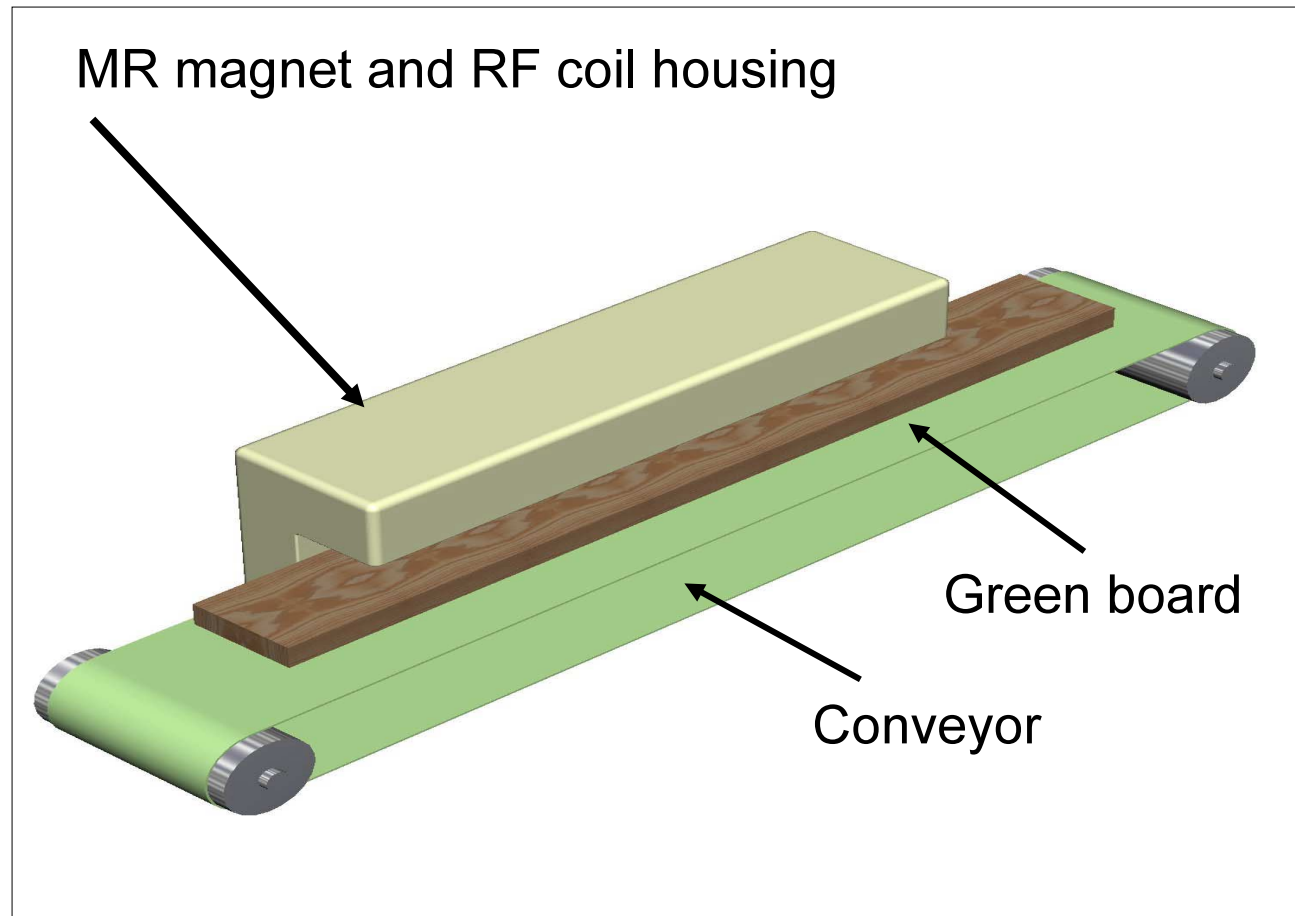
Quantum

Magnetics®

An InVision Technologies Company



# Artist's concept of system



Quantum

Magnetics®

An InVision Technologies Company



# Comparison of moisture content measurement technologies

Measures above fiber saturation point ("Wet" lumber)		
Accurate across Full Moisture Range		
Non-destructive		
Volume Measurement	Volume	
Wood Species Independent		
Measure Sap and Heart Wood		
	Capable	Not Capable

**Q u a n t u m****M a g n e t i c s<sup>®</sup>***An InVision Technologies Company*

## ***Costs incurred by air-drying***

These figures assume a medium size hardwood sawmill processing 5,000,000 board feet per year

Air dry for 90 days – 8% interest on inventory	\$49,315
5% Damage as result of effects of air drying for 90 days (average lumber cost of \$500/1000 board feet)	\$125,000
Cost of handling lumber to and from air drying at \$5.00/1000 board feet	\$25,000
<b>Total value lost to the business per year</b>	<b>\$199,315</b>

**Q u a n t u m****M a g n e t i c s®***An InVision Technologies Company*

## ***Business case for green sort***

- ~9 Billion board-ft kiln dried per year (large market)
- Sawmills like 18 month (or less) payback times on instrumentation
- We estimate price of \$100,000 for MR hardware and lumber handling equipment
- Amortized cost for required new kilns will be less than \$100,000 per year
- 1 year payback for medium sized mill

Quantum

Magnetics®

An InVision Technologies Company



## ***Beta testing plans***

- Proposed CY 2002 beta test sites
  - \* Ontario Hardwood      Keysville, VA
  - \* Northwest Hardwood      Eugene, OR
- Holding discussions with a moisture meter manufacturer for possible OEM deal
- Work with Inovec on lumber handling – they have considerable experience with sawmill installations

Quantum

Magnetics®

An InVision Technologies Company



## ***LBNL collaboration***

- QM was asked by DOE to work with LBNL on commercializing technology developed at LBNL
- LBNL focus: wood chips (papermaking)  
QM focus: lumber (especially hardwood)
- QM personnel have met with Prof. Jeff Reimer to discuss technology transfer
- Current plan is to assist with beta testing of LBNL system



Q u a n t u m

M a g n e t i c s<sup>®</sup>

*An InVision Technologies Company*



## *Other IOF's*

- Mining – GammaMetrics interested in MR technology to aid Prompt Gamma Neutron Activation Analysis
- Petroleum – Working with Chevron investigating potential beta testing sites
- Agriculture – have letter of interest from Kansas State
  - \* Grain milling (moisture content)
  - \* Gasohol (cellulose content), biodiesel (oil content)
  - \* Fat/lean ratio in meat – but not on DOE contract

Q u a n t u m

M a g n e t i c s®

*An InVision Technologies Company*



## ***Beta test system***

- Magnet design – Done
  - \* Construction awaiting funding
- RF coil design – in progress
  - \* Will do mock-up
- System console
  - \* Will use QM proprietary spectrometer hardware and software
  - \* 2 options for RF amplifier
  - \* Minor additions to current software